

NWS FORM E-5 COMMERCE	U.S. DEPARTMENT OF NOAA, NATIONAL WEATHER	HSA OFFICE: San Juan, PR (SJU)
SERVICE		REPORT FOR (MONTH / YEAR): September, 2004
MONTHLY REPORT OF RIVER AND FLOOD CONDITIONS		
TO: NATIONAL WEATHER SERVICE HYDROMETEOROLOGICAL INFO CENTER, W/OS31 SSMC 2 – Room 13468 1325 EAST-WEST HIGHWAY SILVER SPRING, MD 20910-3283		DATE: October 5, 2004
		SIGNATURE: Peter Corrigan
When no flooding occurs, include miscellaneous river conditions, such as significant rises, record low stages, ice conditions, snow cover, droughts, and hydrologic products issued (WSOM E-41).		

Summary: September was dominated by the passage of Tropical Storm Jeanne across the U.S. Virgin Islands and Puerto Rico around mid-month. Preliminary data showed that precipitation was well above normal for the month across most of Puerto Rico and the U.S. Virgin Islands, primarily due to the effects of Jeanne. At San Juan ASOS, rainfall amounted to 9.81" or 4.21" above normal. This was the 7th wettest September at San Juan since 1956 and the wettest since 1998. At St. Thomas, USVI (Truman Field) 13.90" fell versus a normal of 5.34".

Convective activity was light and scattered the first few days of the month in the wake of Hurricane Frances. Tropical depression #9 formed around 9.7°N, 29.1°W early on September 2nd and became Tropical Storm Ivan early on the 3rd. Ivan maintained a track to the south of Puerto Rico and passed the islands as a Category 4 hurricane, becoming a Category 5 for a period thereafter. Scattered to numerous showers and thunderstorms affected much of Puerto Rico from the 3rd through the 5th, with the most widespread coverage on the 5th, when Urban/Small Stream Flood Advisories were issued for 43 municipalities. Rainfall of 2 to 3 inches was observed over parts of the northwest and central mountains, although no flooding reports were received. On the 7th there was very strong afternoon convection that focused over the southwest parts of the island, and built back into the central mountains. An Urban and Small Stream Flood Advisory for 11 municipalities was issued in the mid-afternoon and a Special Weather Statement for near severe thunderstorm activity over much of the same area. The most intense storms drifted west over Adjuntas, prompting a rare (for Puerto Rico) Severe Thunderstorm Warning for that municipality. Intense rainfall from this cell produced flooding conditions on several small basins in the upper reaches of the Rio Grande de Arecibo and Rio Grande de Anasco. Evidence is provided by the stream response at the USGS gage near Adjuntas (ADKP4). This 12.7 mi² basin saw a discharge increase from around 150 cfs (cubic feet per second) and a gage height 6.42 feet at 18:15 UTC to 10,300 ft³/sec, gage height 14.34 feet only one hour later. A similar increase in flow on nearby small streams caused the loss of a life as the Rio Yayaes, a small tributary of the Rio Guilarte, surged out of its banks and flowed across the intersection of Highways 131 and 135. A 59-year old woman drove a car into the moving waters, attempted to escape her car and was drowned. Several other persons on the same road narrowly escaped a similar fate, including a car with three children. Radar rainfall estimates over parts of the affected basins was 3 to 6 inches, and the highest rain gage amounts were at Rio

Guanajibo at Sabana Grande (ZOBP4), 3.15"; Adjuntas (ADKP4), 3.12"; Barrio Saltillo near Adjuntas (ADSP4), 2.62"; Adjuntas 5NW (AJTP4), 2.25" and Rio Rosario near Hormigueros (MAYP4), 1.97". Most of the rain fell in a 1 to 2 hour period.

The following day again saw very intense rainfall in southwest and west central Puerto Rico, albeit with lesser areal coverage. The heaviest rains fell in portions of the Rio Hormigueros basin, especially in the Rio Rosario. The USGS gage near Hormigueros (MAYP4) received 6.20" of rain, nearly all of which fell in less than 3 hours. The station received hourly totals of 2.19" and 2.69" in consecutive hours ending at 2000 UTC. Fortunately, this was extremely was a very isolated amount, and other rainfall was much less, including 2.00" at Rio Grande de Patillas (PATP4); 1.89" at Rio Guanajibo near Hormigueros (HORP4), and 1.88" at Rio Grande de Loiza at Quebrada Arenas (SLLP4).

The periphery of Hurricane Ivan's rain bands affected parts of the island on the 8th, with convection primarily over the far west and portions of southeast Puerto Rico. Urban and Small Stream Flood Advisories were issued for several municipalities as 1 to 2 inches of rain fell. After several dry days, activity developed over west central Puerto Rico on the 11th, requiring a widespread (20 municipalities) Urban and Small Stream Flood Advisory as rains of over 2 inches fell at a number of rain gage locations. The 12th saw convection confined primarily to the central cordillera, with several locations picking up in excess of 2 inches again and Flood Advisories for five municipalities. The 13th was another active day over Puerto Rico with a total of 26 Flood Advisories posted, primarily over the west central part of the island. Rainfall totals were substantially less than in previous days, with no locations picking up even two inches of rain.

What as to become Tropical Storm Jeanne developed very rapidly out a tropical depression located to the east of the Leeward Islands on the 13th. For a more complete summary of Jeanne see <http://www.srh.weather.gov/sju/jeanne.html>. Jeanne became a named system on the 14th as the center tracked south of the U.S. Virgin Islands and Vieques, Puerto Rico early on the 15th. A Flood Watch for Flash Flooding was issued during the early evening of the 14th as the outer rain bands from the storm began to affect these areas. The storm entered the southeast coast of Puerto Rico and basically traversed the island during the day, skirting the northwest coast before exiting about 00Z on the 16th. The hydrologic impact of Jeanne was widespread, with numerous streams and rivers flooding. Flash Flood Warnings were initially issued for the U.S. Virgin Islands, Vieques and Culebra very early on the 15th and extended over the course of the day to cover every municipality in Puerto Rico. These warnings were reissued throughout the day and into the 16th, resulting in over 300 Flash Flood Warnings issued on the 15th and over 150 on the 16th. River Flood Warnings were issued for the Rio Cibuco, Rio de la Plata and Rio Guanajibo on the 16th. Some of the more serious impacts were reported from Vieques, where 23.75" of rain fell over several days. Reports of damage to streets, collapsed bridges and landslides were received from the island. In the U.S. Virgin Islands there were similar reports of damage. Evacuations of up to 400 people were reported along parts of the Rio Grande de Anasco and there were numerous road closures due to flooding and mudslides throughout Puerto Rico. Only one flood related fatality was reported: In the Moca area, a 45-year old man was reportedly drowned in a tributary stream of the Rio Culebrinas. A table of rainfall data from the three days of Jeanne's most direct effects is shown below:

Table 1. Twenty-four hour rainfall ending at 1200 UTC for the three days associated with Tropical Storm Jeanne.

Station (NWS ID)	Sep 15	Sep 16	Sep 17	3-Day total
Vieques – Camp Garcia (WVEP4)	2.20	14.75	6.78	23.75
Aibonito 1S (ALPP4)	1.17	15.00	2.50	18.67
Rio Icacos nr Naguabo (NGIP4)	2.67	13.81	1.96	18.44
Rio Mameyes nr Sabana (MSAP4)	1.91	13.92	1.26	17.09
Lago De Matrullas - Orocovis (OROP4)	0.28	9.54	5.46	15.28
Rio Matrullas Alert gage (ZDDP4)	0.47	7.68	7.05	15.20
Queb. Blanca nr San Lorenzo (SLGP4)	1.60	10.78	2.46	14.84
Jayuya RG nr Bo. Saliente (JAZP4)	0.29	9.78	4.73	14.80
Corozal Alert gage (ZDBP4)	1.14	8.86	4.25	14.25
Rio Turabo abv Borinquen (CAKP4)	2.09	10.21	1.92	14.22
Rio Coamo at Hwy 14 (COAP4)	0.31	8.36	5.14	13.81
Queb. Salvatierra nr San Lorenzo (SLJP4)	1.48	10.78	2.46	13.19
Pueblito del Rio RG nr Gurabo (GUSP4)	1.60	10.83	0.55	12.98
Charlotte Amalie, St. Thom. USVI (XTCP4)	1.79	9.25	1.73	12.77
Barrio Beatriz RG nr Caguas (BZDP4)	0.70	10.94	0.76	12.40
Quebrada Arenas (SLLP4)	2.16	7.99	2.22	12.37
Turpentine Run, St. Thom. USVI (XTFP4)	1.86	8.50	1.73	12.09
Rio Mameyes at Mameyes (MSEP4)	1.08	9.97	0.98	12.03
Rio Fajardo at Hwy 976 (FAJP4)	1.44	9.26	1.30	12.00
Rio De La Plata nr Naranjito (ZEEP4)	2.13	8.39	1.39	11.90
Rio Blanco nr Florida (NGKP4)	1.73	8.01	2.01	11.75
Rio Espiritu Santo nr Rio Grande (VEDP4)	1.12	9.66	0.89	11.67
Rio Canovanas nr Campo Rico (CNAP4)	0.77	9.31	1.47	11.55
Rio De Bayamon at Arenas (CIFP4)	0.66	10.13	0.72	11.51
Lago De Cidra (DRAP4)	1.48	9.44	0.35	11.28
Bisley Meteorological Stn. (MSCP4)	1.02	9.15	0.83	11.00

According the Weather Bureau Technical Paper No. 42 (1961) 24-hour rainfall of such magnitude corresponds to anywhere from a 5-year to in excess of a 100-year return period, depending very much on specific locations. The highest return frequency was at Aibonito, where the 24-hour rainfall of 15.00" corresponded to more than a 100-year event. The 14.75" at Vieques was close to a 100-year event, while at Charlotte Amalie, the maximum 24-hour rainfall of 9.25 inches was around a 25-year event. The nearly 10 inches at Rio Mameyes however, was closer to a 10-year event. The flooding produced by these rains was widespread, although not particularly severe. A total of 54 locations (including 11 of the 13 NWS forecast locations) exceeded Flood Stage at some time during the event, covering nearly the entire island. A slight majority (27) reached the NWS-defined Moderate Flood Stage, 23 reached only Minor Flood Stage and only 4 achieved Major Flood Stage. The most serious flooding appears to have occurred in the lower portions of Rio Grande de Manati and in the Rio de la Plata and Rio Culebrinas basins, where Major Flood Stage was reached at several locations. No river gage stations in Puerto Rico established a new flood of record, and the return frequency for discharge ranged from less than a 2-year event up to a 25 to 50-year event on several rivers. One station in the U.S. Virgin Islands, Turpentine Run at Mt. Zion (XTFP4), set a new record of 8.65 feet, which broke the previous record of 7.28 feet set in 1995. It is important to note that streamflow records at this site only extend back 10 years.

A very moist and unstable air mass remained across the area on the 17th and 18th and Flood Watches for Flash Flooding were issued both days due the already high state of rivers and saturated soils from Jeanne's rainfall. Numerous Flash Flood Warnings (30) were issued on the 18th as rainfall of 1 to 2 inches occurred over the western portions of Puerto Rico and the ground remained saturated from Tropical Storm Jeanne. However, no reports of flooding in the affected municipalities were received by the NWS.

Widely scattered convection affected Puerto Rico on the 21st and 22nd, as bands of moisture from a renewed Hurricane Jeanne now located east of the Bahamas trailed across the island. The southwesterly flow with very high moisture produced heavy rainfall over parts of the San Juan metro area both days, prompting several Urban and Small Stream Flood Advisories. The presence of Jeanne to the north and Hurricanes Lisa and Karl to the east combined for the next several days to disturb the northeast trade wind flow across the island and produce southerly flow. Most areas saw hot, dry weather, with only widely scattered shower activity. San Juan ASOS tied a record high temperature on the 24th reaching 94°F, also the highest so far in 2004. The only hydrologic event of note was on the 26th when localized showers in the San Juan area and around Arecibo produced some minor flooding.

A upper-level trough moved from the northeast of Puerto Rico westward through Hispaniola over several days at the end of the month assisting in the development of scattered shower activity. An Urban and Small Stream Advisory was issued for Juana Diaz on the 28th in response to WSR-88D estimates of up to 4 inches over a small area. An increase in low-level moisture on the 29th, combined with southeasterly upper-level flow around the persistent trough brought an increase in shower activity with moderate to heavy rainfall observed over central mountains. Urban and Small Stream Flood Advisories for 12 municipalities were issued during the late afternoon, as rainfall of 1 to 3 inches was estimated by radar. The last day of the month saw a scattered strong convection, primarily around the San Juan metro area. A Flash Flood Warning for San Juan was issued and an Urban and Small Stream Flood Advisory for 10 surrounding municipalities.

Non-Routine Hydrologic Products Issued:

Hydrologic Outlooks (SJUESFSJU):	0
Flood Watches (SJUFFASJU):	4
Flood Warnings (SJUFLWSJU):	5
Flash Flood Warnings (SJUFFWSJU):	504
Urban/Small Stream Flood Advisories: (SJUFLSSJU)	186

- cc: USGS Caribbean District
 USCE Jacksonville Division
 SRH Climate, Weather and Water Division
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